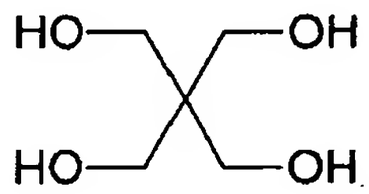
In the Claims

This listing of claims will replace all prior versions, and listings, of claims in the application

PROPOSED Listing of Claims

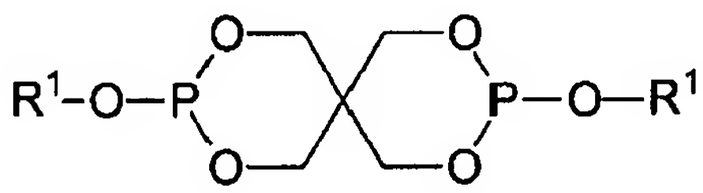
1. (currently amended) ~~An improved~~ A method for synthesizing pentaerythritol diphosphites comprising the steps of:

(a) transesterifying pentaerythritol of formula (I)



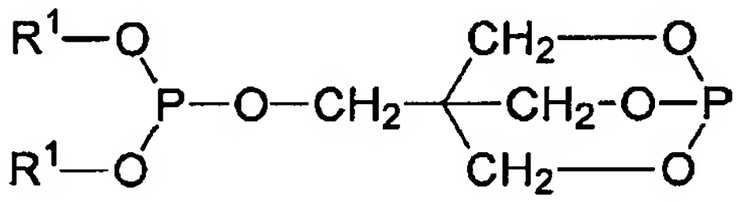
(I)

with a monophosphite of formula P-$(OR^1)_3$ to form a first reaction mixture which comprises an intermediate pentaerythritol diphosphite having a spiro isomer as shown in the following formula (III),



(III)

a caged isomer shown in the following formula (IV),

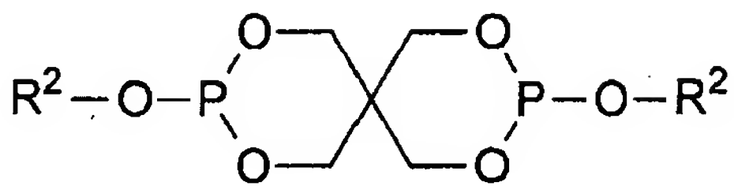


(IV)

unreacted monophosphite and side reaction products wherein R^1 is selected from the group consisting of straight-chain or branched C_{1-20} alkyl groups, C_{5-7} cycloaliphatic groups, straight-chain or branched C_{2-30} alkenyl groups, C_{6-18} aryl groups, C_{7-40} alkylaryl groups and C_{7-40} arylalkyl groups;

(b) removing reaction products by distillation other than said intermediate pentaerythritol diphosphite from said first reaction mixture; and

(c) transesterifying said intermediate pentaerythritol diphosphite with an alcohol selected from the group consisting of C_{8-22} alkanols, C_{8-22} alkenols, phenols, C_{7-40} alkylaryl alcohols and C_{7-40} arylalkyl alcohols to form a second reaction mixture which comprises a final pentaerythritol diphosphite of formula (VI)



(VI)

where R^2 is selected from the group consisting of C_{8-22} alkyls, C_{8-22} alkenyls, phenyl, C_{7-40} alkylaryls and C_{7-40} arylalkyls.

2. (previously presented) The method of claim 1 which further comprises the step of separating said intermediate pentaerythritol diphosphite from said first reaction mixture to produce a purified intermediate pentaerythritol diphosphite

3. (previously presented) The method of claim 2 wherein said monophosphite is selected from the group consisting of trimethyl phosphite, triethyl phosphite and triphenyl phosphite.

4 (previously presented) The method of claim 3 wherein said monophosphite is triphenyl phosphite.

5 (previously presented) The method of claim 4 wherein said intermediate pentaerythritol diphosphite is diphenyl pentaerythritol diphosphite.

6 (previously presented) The method of claim 1 wherein a ratio of said monophosphite to said pentaerythritol is about 2 moles of monophosphite per mole of pentaerythritol.

7. (currently amended) The method of claim 1 which further comprises an alkaline catalyst in said first transesterification step (a)

8. (currently amended) The method of claim ~~1~~ 7, wherein said amount of said alkaline catalyst ranges from about 0 01 weight percent to about 5 weight percent, based on the intermediate pentaerythritol diphosphite.

9. (previously presented) The method of claim 1 wherein said alcohol is 2,4-dicumyl phenol.

10. (previously presented) The method of claim 1, wherein said first transesterification reaction pressure is in a range from about 0 01 mm Hg to about 100 mm Hg.

11. (previously presented) The method of claim 10 wherein said first transesterification reaction temperature is in a range from about 70°C to about 105°C.

12 (previously presented) The method of claim 11 wherein said first reaction mixture further comprises a solvent

13. (previously presented) The method of claim 12, wherein said solvent is selected from the group consisting of C_6-C_{20} aromatic hydrocarbons and C_6-C_{20} aliphatic hydrocarbons and blends thereof.

14 (previously presented) The method of claim 13, wherein said solvent is added in an amount ranging from about 10 weight percent to about 200 weight percent of said intermediate pentaerythritol diphosphite

15. (previously presented) The method of claim 11 wherein said intermediate pentaerythritol diphosphite comprises a spiro isomer content of greater than 90 percent.

16. (previously presented) The method of claim 15 wherein said intermediate pentaerythritol diphosphite has a yield of greater than 95 percent, based on the pentaerythritol.

17 (previously presented) The method of claim 2 wherein said separating step comprises distillation of said reaction mixture sufficient to purify said intermediate pentaerythritol diphosphite to a purity of at least 99 percent

18 (previously presented) The method of claim 17 wherein the purity of said intermediate pentaerythritol diphosphite is at least 99 9 percent.

19. (previously presented) The method of claim 2 further comprising the step of separating said second pentaerythritol diphosphite from said second reaction mixture.

20 (previously presented) The method of claim 19 wherein said step of separating said second pentaerythritol diphosphite from said second reaction mixture comprises a step of distillation

21. (previously presented) The method of claim 19 wherein said alcohol is selected from the group consisting of 2,4-di-t-butylphenol and 2,4-dicumylphenol

22. (previously presented) The method of claim 21 wherein said alcohol is 2,4-dicumylphenol.

23. (previously presented) The method of claim 19 wherein said final pentaerythritol diphosphite is selected from the group consisting of bis(2,4-dicumylphenyl) pentaerythritol diphosphite and bis (2,4-di-t-butylphenyl) pentaerythritol diphosphite

24 (currently amended) The method of claim 19 wherein ~~said second~~ a temperature of said second transesterification reaction in step (c) is in a range of about ~~130~~120°C to about 170°C.

25 (currently amended) The method of claim 24 whereln ~~said second~~ a pressure of said second transesterification reaction in step (c) is in a range of about 0.01 mm Hg to about 100 mm Hg.

26. (previously presented) The method of claim 19, wherein the amount of said alcohol ranges from about 2 moles to about 8 moles per mole of said intermediate pentaerythritol diphosphite

27 (currently amended) The method of claim 19, which further comprises ~~a second~~ an alkaline catalyst in said second transesterification reaction in step (c).

28. (currently amended) The method of claim 27, wherein the amount of said ~~second~~ alkaline catalyst is in a range of about 0.01 weight percent to about 5 weight percent, based on the final pentaerythritol diphosphite

29. (previously presented) The method of claim 19, wherein said final pentaerythritol diphosphite comprises a spiro isomer content of greater than 90 mole percent.

30 (currently amended) ~~An improved~~ A method for synthesizing pentaerythritol diphosphites comprising the steps of:

(a) transesterifying pentaerythritol with a monophosphite to form a first reaction mixture which comprises an intermediate pentaerythritol diphosphite and unreacted monophosphite and side reaction products at a temperature below 125°C;

(b) removing reaction products by distillation other than said intermediate pentaerythritol diphosphite from said first reaction mixture; and

(c) transesterifying said intermediate pentaerythritol diphosphite with an excess of an alcohol to form a second reaction mixture which comprises a final pentaerythritol diphosphite at a temperature below 175°C, said final pentaerythritol diphosphite having a spiro content in excess of 90 mole percent without purification by recrystallization

31. (previously presented) The method of claim 30 which further comprises the step of separating said intermediate pentaerythritol diphosphite from said first reaction mixture to produce a purified intermediate pentaerythritol diphosphite.

32. (previously presented) The method of claim 31 wherein said monophosphite is selected from the group consisting of trimethyl phosphite, triethyl phosphite and triphenyl phosphite

33 (previously presented) The method of claim 32 wherein said monophosphite is triphenyl phosphite

34 (previously presented) The method of claim 33 wherein said intermediate pentaerythritol diphosphite is diphenyl pentaerythritol diphosphite.

35 (previously presented) The method of claim 30 wherein a ratio of said monophosphite to said pentaerythritol is about 2 moles of monophosphite per mole of pentaerythritol

36. (currently amended) The method of claim 30 which further comprises an alkaline catalyst in said first transesterification reaction in step (a)

37. (previously presented) The method of claim 30, wherein said amount of said alkaline catalyst ranges from about 0 01 weight percent to about 5 weight percent, based on the intermediate pentaerythritol diphosphite.

38. (previously presented) The method of claim 30 wherein said alcohol is 2,4-dicumyl phenol

39. (currently amended) The method of claim 30, wherein ~~said first transesterification~~ a reaction pressure of said first transesterification reaction in step (a) is in a range from about 0 01 mm Hg to about 100 mm Hg.

40 (currently amended) The method of claim 39 wherein ~~said first transesterification~~ a reaction temperature of said first transesterification reaction in step (a) is in a range from about 70°C to about 105°C

41. (previously presented) The method of claim 40 wherein said first reaction mixture further comprises a solvent

42 (previously presented) The method of claim 41, wherein said solvent is selected from the group consisting of C_6-C_{20} aromatic hydrocarbons and C_6-C_{20} aliphatic hydrocarbons and blends thereof.

43 (previously presented) The method of claim 42, wherein said solvent is added in an amount ranging from about 10 weight percent to about 200 weight percent of said intermediate pentaerythritol diphosphite.

44. (previously presented) The method of claim 30 wherein said intermediate pentaerythritol diphosphite comprises a spiro isomer content of greater than 90 percent

45 (previously presented) The method of claim 44 wherein said intermediate pentaerythritol diphosphite has a yield of greater than 95 percent, based on the pentaerythritol.

46. (previously presented) The method of claim 31 wherein said separating step comprises distillation of said reaction mixture sufficient to purify said intermediate pentaerythritol diphosphite to a purity of at least 99 percent.

47. (previously presented) The method of claim 46 wherein the purity of said intermediate pentaerythritol diphosphite is at least 99.9 percent.

48 (previously presented) The method of claim 31 further comprising the step of separating said second pentaerythritol diphosphite from said second reaction mixture.

49. (previously presented) The method of claim 48 wherein said step of separating said second pentaerythritol diphosphite from said second reaction mixture comprises a step of distillation.

50 (previously presented) The method of claim 48 wherein said alcohol is selected from the group consisting of 2,4-di-t-butylphenol and 2,4-dicumylphenol

51. (previously presented) The method of claim 50 wherein said alcohol is 2,4-dicumylphenol.

52 (previously presented) The method of claim 48 wherein said final pentaerythritol diphosphite is selected from the group consisting of bis(2,4-dicumylphenyl) pentaerythritol diphosphite and bis (2,4-di-t-butylphenyl) pentaerythritol diphosphite

53 (currently amended) The method of claim 48 wherein ~~said second~~ a temperature of said second transesterification reaction of step (c) is in a range of about ~~130~~ 120°C to about 170°C.

54 (currently amended) The method of claim 53 wherein ~~said second~~ a pressure of said second transesterification reaction of step (c) is in a range of about 0.01 mm Hg to about 100 mm Hg

55. (previously presented) The method of claim 48, wherein the amount of said alcohol ranges from about 2 moles to about 8 moles per mole of said intermediate pentaerythritol diphosphite.

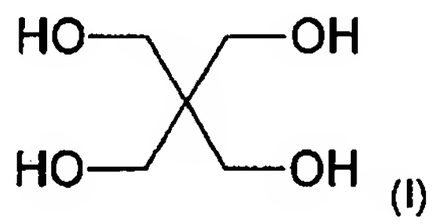
56 (currently amended) The method of claim 48, which further comprises a second alkaline catalyst in said second transesterification reaction of step (c)

57. (currently amended) The method of claim 56, wherein the amount of said ~~second~~ alkaline catalyst is in a range of about 0.01 weight percent to about 5 weight percent, based on the final pentaerythritol diphosphite.

58 (previously presented) The method of claim 48, wherein said final pentaerythritol diphosphite comprises a spiro isomer content of greater than 90 mole percent

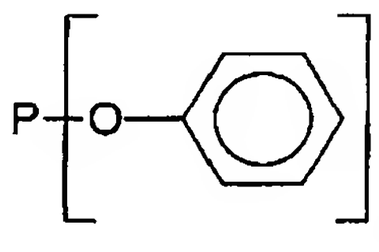
59. (currently amended) ~~An improved~~ A method for synthesizing bis(2,4-dicumylphenyl) pentaerythritol diphosphite comprising the steps of:

(a) transesterifying pentaerythritol of formula (I)



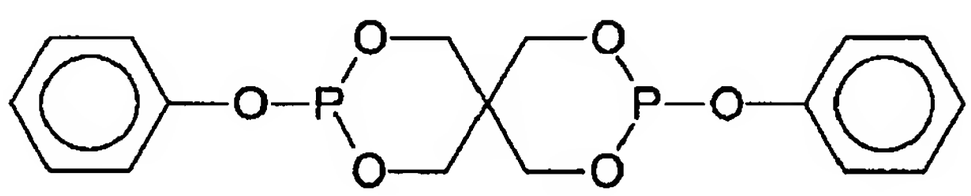
(I)

with triphenyl phosphite of formula (II)



(II)

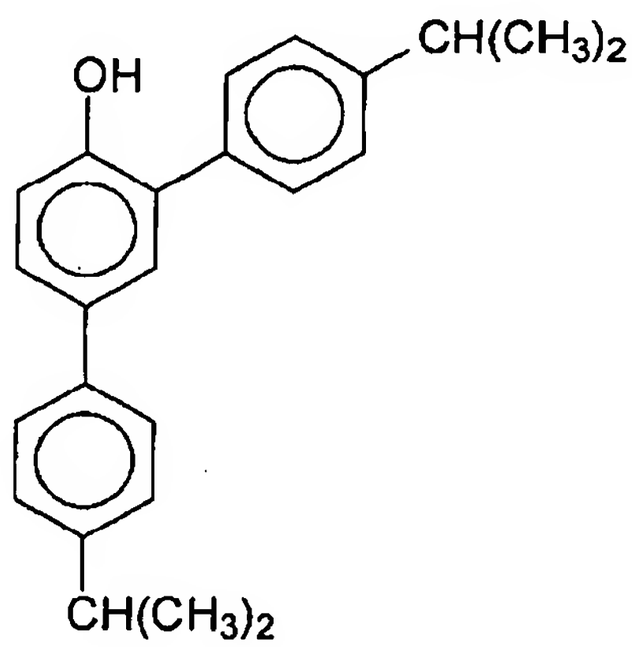
to form an intermediate reaction mixture comprising diphenyl pentaerythritol diphosphite of formula (V)



(V);

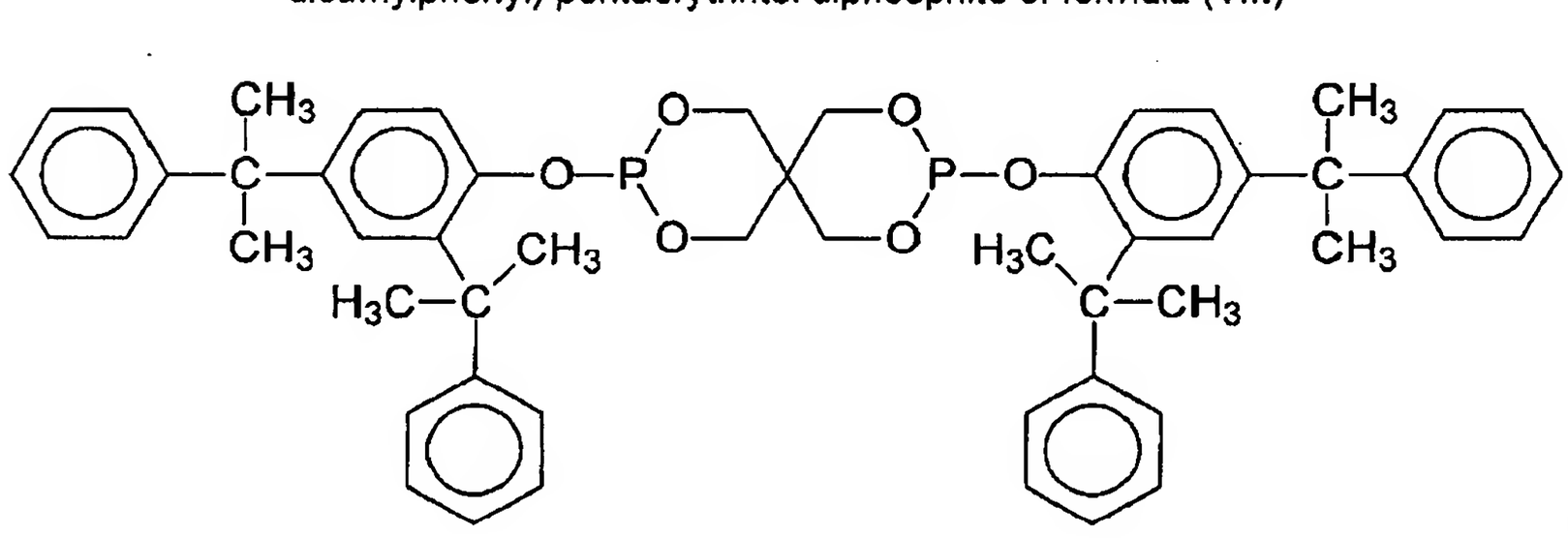
(b) removing phenol and reaction products by distillation other than diphenylpentaerythritol diphosphite from said intermediate reaction mixture;

(c) transesterifying said intermediate pentaerythritol diphosphite with 2,4-dicumyl phenol of formula (VIII)



(VII)

to form a second reaction mixture which comprises a final pentaerythritol diphosphite bis(2,4-dicumylphenyl) pentaerythritol diphosphite of formula (VIII)



(VIII); and

(d) removing phenol from said second reaction mixture.

60. (previously presented) The method of claim 59 wherein a ratio of said triphenyl phosphite to said pentaerythritol is about 2 moles of triphenyl phosphite per mole of pentaerythritol.

61. (currently amended) The method of claim 59 which further comprises an alkaline catalyst for said first transesterification reaction in step (a)

62 (previously presented) The method of claim 61, wherein said amount of said alkaline catalyst ranges from about 0 01 weight percent to about 5 weight percent, based on the intermediate diphenyl pentaerythritol diphosphite.

63. (previously presented) The method of claim 62, wherein said first transesterification reaction pressure is in a range from about 0 01 mm Hg to about 100 mm Hg.

64 (previously presented) The method of claim 63 wherein said first transesterification reaction temperature is in a range from about 70°C to about 105°C.

65. (previously presented) The method of claim 64 wherein said first reaction mixture further comprises a solvent.

66. (previously presented) The method of claim 65, wherein said solvent is selected from the group consisting of C_6-C_{20} aromatic hydrocarbons and C_6-C_{20} aliphatic hydrocarbons and blends thereof.

67. (previously presented) The method of claim 66, wherein said solvent is added in an amount ranging from about 10 weight percent to about 200 weight percent of said intermediate diphenyl pentaerythritol diphosphite

68. (previously presented) The method of claim 67 wherein said intermediate diphenyl pentaerythritol diphosphite comprises a spiro isomer content of greater than 90 percent

69. (previously presented) The method of claim 68 wherein said intermediate diphenyl pentaerythritol diphosphite has a yield of greater than 95 percent, based on the pentaerythritol

70 (currently amended) The method of claim 59 wherein said step of removing phenol from said first reaction mixture ~~comprises~~ by distillation

71 (previously presented) The method of claim 70 wherein said step of removing phenol from said reaction mixture purifies said intermediate diphenyl pentaerythritol diphosphite to a purity of at least 99 percent.

72. (previously presented) The method of claim 71 wherein the purity of said intermediate diphenyl pentaerythritol diphosphite is at least 99 9 percent

73. (currently amended) The method of claim 70 wherein said step of removing phenol from said second reaction mixture ~~comprises~~ by distillation.

74 (currently amended) The method of claim 73 wherein ~~said second~~ a temperature of said second transesterification reaction of step (c) is in a range of about ~~130~~ 120°C to about 170°C

75 (currently amended) The method of claim 74 wherein ~~said second~~ a pressure of said second transesterification reaction of step (c) is in a range of about 0 01 mm Hg to about 100 mm Hg.

76. (previously presented) The method of claim 75, wherein the amount of said 2,4-dicumyl phenol ranges from about 2 moles to about 8 moles per mole of said intermediate diphenyl pentaerythritol diphosphite.

77. (previously presented) The method of claim 76, which further comprises a second alkaline catalyst for said second transesterification step.

78 (previously presented) The method of claim 77, wherein the amount of said second alkaline catalyst is in a range of about 0 01 weight percent to about 5 weight percent, based on the bis(2,4-dicumylphenyl) pentaerythritol diphosphite

79 (previously presented) The method of claim 78, wherein said final bis(2,4-dicumylphenyl) pentaerythritol diphosphite comprises a spiro isomer content of greater than 90 mole percent.

80. (canceled)

81. (canceled)

82. (canceled)

83. (canceled)

84. (canceled)

85. (canceled)

86. (canceled)

87. (canceled)

88. (canceled)

89. (canceled)

90 (currently amended) The ~~process~~ method of claim 1 in which said first and second transesterification reactions are performed without a solvent.

91. (currently amended) The ~~process~~ method of claim 30 in which said first and second transesterification reactions are performed without a solvent

92 (currently amended) The ~~process~~ method of claim 59 in which said first and second transesterification reactions are performed without a solvent.